DAMODAR VALLEY CORPORATION

REPORT OF THE LOWER DAMODAR INVESTIGATION COMMITTEE

VOLUME I

Calcutta
March 1957.

DAMODAR VALLEY CORPORATION.

REPORT OF THE

Lower Damodar Investigation Committee.

VOLUME I

CALCUTTA
MARCH 1957

Report of the Lower Damodar Investigation Committee

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VOLUME I

LOWER DAMODAR INVESTIGATION C MITTEE
(D. V. C.)

CAMP : CALCUTTA

March 4, 1957.

The Chairman
Damodar Valley Corporation
Anderson House, Alipore
Calcutta-27

Dear Sir:

Reference is invited to D.V.C.'s Memorandum No.WI-G/21-1880 of February 24, 1955 appointing the Lower Damodar Investigation Committee under Section 10 of the D.V.C. Act. This Committee was requested to examine the possible effects of the D.V.C. dams on the lower reaches of the Damodar River and the Rupnarain and to suggest steps to be taken for preventing deterioration of these rivers.

The Committee has examined in detail the available data and the report thereof is submitted herewith.

Yours faithfully,

(G. R. Garg)
Chairman.

Enclo: 1 Report.

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REPORT OF THE LOWER DAMODAR INVESTIGATION COMMITTEE (1955-57).

CHAPTER I

INTRODUCTION

A. Appointment of the Committee.

The Damodar Valley Corporation vide Memorandum No.WI-G/21-1880 dated February 24, 1955 (Appendix - 1) set up a Committee to examine the possible effects of the D.V.C. dams on the lower reaches of the Damodar River and the Rupnarain. The Committee was constituted as follows:

(1) Sri G.R. Garg, ISE(Retd.)	..	Chairman.
(2) Dr. N.K. Bose,Ph.D.,F.N.I.	..	Member.
(3) Sri G.B. Mondal, ISE (Retd.)	..	Member.
(4) Sri S.P. Sarathy	..	Member.
(5) Sri D. Mookerjea	..	Member.
(6) Sri H.J. Ajwani	..	Member-Secretary

Subsequently Sri N. S. Iyengar was appointed as Member-Secretary in place of Sri H. J. Ajwani.

The Damodar Valley Corporation in their Memorandum No.WI-G/21-528 dated January 16, 1956, nominated Sri A.L.Das, ISE to be member of the Committee.

On the retirement of Dr. N. K. Bose from the River Research Institute, West Bengal, and his subsequent appointment as Member-Secretary, West Bengal Flood Enquiry Committee, he continued as a Member. The Damodar Valley Corporation requested Sri B. Maitra, Director, River Research Institute, West Bengal,

to be present in the deliberations of the Committee.

The Terms of Reference of the Committee were :

(a) to examine in detail the available data and suggest what further information will be required with respect to the regime of the Lower Damodar and the Rupnarain;

(b) to assess the possible effects of the DVC dams on the lower reaches of the Damodar river and the Rupnarain;

(c) to suggest what steps, if any, should be taken for preventing deterioration of the Lower Damodar and the Rupnarain and

(d) to make such other recommendations pertinent to the subject which they may consider necessary.

B. Meetings of the Committee.

We met for the first time at Anderson House, Calcutta, on the 28th April, 1955, followed by inspection of outfalls of the Damodar and the Rupnarain and also the trans-Damodar area. We examined the available hydrological and topographical data. In view of the complicated nature of the problem, we recommended that further hydrological and topographical data should be collected. A copy of the preliminary report covering the proceedings of this meeting is included as Appendix - 2.

The second meeting of the Committee was held at Anderson House, Calcutta, from 3rd January to 14th January 1956. During this meeting the hydrological data collected as per recommendations of the Committee during the monsoon of 1955 (Appendix - 3) were examined. The river stretch from Raniganj to Geonkhali was inspected from air. The representations of some societies and organisations (Appendix - 4) sent to us were examined.

Views of some engineers who were acquainted with the problems of the lower valley were heard (Appendix - 5). The Committee paid a short visit to the Hooghly estuary model at the Central Water & Power Research Station, Poona. The technical aspects of the problems were discussed with Sri D. V. Joglekar, Director, and other officers of the Central Water & Power Research Station, Poona. The Committee felt that the aerial photography and also data regarding the river cross-sections along the old Damodar course for as many years as may be available from the old records should be collected.

The final session of the Committee was held at Calcutta from 25.2.57 to 4.3.57.

CHAPTER II

EXAMINATION OF THE AVAILABLE DATA AND SUGGESTION REGARDING FURTHER INFORMATION TO BE COLLECTED.

The hydrological and topographical data collected from the various authorities namely Govt. of West Bengal, Calcutta Port Commissioners and the Damodar Valley Corporation were examined by the Committee. The Committee also inspected various stretches of the rivers and had an aerial reconnaissance of the river from Raniganj upto the outfall into the Hooghly. Several representations received by the Committee were considered. Views of some of the engineers who had been expressing their opinion on this subject through the medium of the press were also heard. Some of the existing breaches (hanas) on the right bank of the river

were inspected and the views of the local people ascertained.

The Committee also took advantage of the existing model of the Hooghly estuary now being operated in the Central Water & Power Research Station at Poona to study the flow conditions in the tidal reaches of the Rupnarain, the Damodar and the Hooghly.

From studies of the data as well as from discussions with the various authorities the following points emerged:

Prior to the 18th century bulk of the Damodar discharge used to flow into the Hooghly at Nayasarai, 39 miles above Calcutta. Subsequently, in the early part of the 19th century, main flow of the Damodar moved down to the Hooghly through the Amta channel having its outfall near Falta point, about 70 miles to the south of the old one. It is reported that before 1857 a spill channel had formed on the right bank of the river Damodar below Jamalpur. From an old plan it would appear that in 1857 a bund was put up across the Damodar below this spill channel which might have helped in the development of the Begua Hana. Later on, a cut off was effected joining the neck of the loop formed by the Begua Hana. This cut off is known as Muchi Hana. At present, up to about 50,000 cusecs at Rhondia the entire discharge of the Damodar flows through this hana. At higher stages, a part of the discharge, though small, goes into the Amta channel (Appendix - 6).

The river Damodar has a large number of hanas on the right bank taking off from the main river below Anderson Weir. Considerable quantity of flood discharge (Appendix - 7) passes through these hanas into the adjacent areas. These areas get

silt-laden water during floods ranging from 50,000 cusecs to 200,000 cusecs at Rhondia which has the effect of adding to the fertility of the cultivable land. Above this stage the river starts spilling over the right bank where considerable quantity of sand deposits damaging the cultivable lands.

It is observed that the bed of the hanas and chars inside the river bed are covered with vegetation. Big trees are also seen growing on the river bed. Such vegetation traps the silt in the river. Besides this, the hanas and the spill water take less quantity of silt and leave more to be deposited on the river bed. In consequence flood levels have risen and the bankful capacity has deteriorated.

In the past, the Damodar river was uncontrolled. In a period of high flood there was always a danger of embankment breaching and the flood water passing into the adjoining country and damaging it. Thus damage is caused through not merely by flooding but also by spreading sandy silt as happened between Burdwan and Rasulpur during the 1943 flood.

The main flow of the river Damodar after the bifurcation below Sure Kalna is through the Muchi Hana channel. Upto 50,000 cusecs discharge at Rhondia there is no flow into the Amta channel. Only when the flow exceeds this figure Damodar water enters the Amta channel. During 1956 floods the maximum discharge recorded at Rhondia was 303,000 cusecs and that at Champadanga was computed to be of the order of 25,000 cusecs.

The Damodar water through the Muchi Hana and the Mundeswari and the spill through the trans-Damodar region

flows at a moderated rate into the Rupnarain, 15 miles upstream of Kolaghat. The Rupnarain which also gets upland water from its own catchment plays a very important role in the conservancy of the Hooghly below its outfall at Geonkhali. This river serves as a valuable tidal reservoir to the Hooghly absorbing 50% of the volume of tidal inflow. The Rupnarain also functions as an outlet to the drainage of large areas along banks. The frequent occurrence of floods in the low lying areas adjacent to the upper reaches of this river emphasises the desirability of maintaining this river in good regime to relieve these areas of drainage congestion.

From the data that we have been able to collect so far, it is strongly felt that they are meagre and insufficient for the proper study of the problem and assessment of the dangers and benefits that would accrue to the lower valley from the Damodar Valley Project. We, therefore, strongly recommend that immediate and suitable steps should be taken for carrying out systematic hydrological investigations and observations in this area in a proper and scientific manner as under:

1. Cross-sections of the rivers as follows to extend beyond H.F.L. and to be repeated every year:

(a) Below the two dams (Maithon and Panchet Hill) at one mile apart upto Asansol and thereafter at 5 miles apart upto 10 miles above the Durgapur Barrage.

(b) One mile apart in the stretch 10 miles above and 10 miles below the Durgapur Barrage and thereafter 5 miles apart upto Surekalna.

(c) Cross-sections and two gauging stations one

1000 ft. upstream and another 1000 ft. downstream of the site of cross-section should be taken at

(i) Surekalna.
(ii) Mohiddipur on Damodar.
(iii) Mohiddipur on Kanke.
(iv) Champadanga.
and (v) Mundeswari.

2. Plane-table and contour survey of the area covered by the bifurcations of the Muchi Hana and the Begua Hana from the Damodar at intervals of 5 years and also whenever major changes in the river regime occur.

3. Cubatures of Rupnarain upto Gopigunge and also that of Damodar at intervals of 5 years.

CHAPTER III

EXISTING (PREDAM) CONDITION OF THE LOWER REACHES OF THE DAMODAR AND THE RUPNARAIN.

In order to assess the probable effects of the DVC dams on the lower reaches of the Damodar and the Rupnarain it is necessary to get a clear picture of the present condition of the lower valley of the Damodar and the Rupnarain rivers before the Damodar Valley Project has come into operation. For this purpose the lower valley has been divided into the following four reaches:

(1) The reach from Durgapur Barrage to Sure Kalna (the bifurcation point of the old Damodar and the Kanke river).

(2) The Kanke river from Sure Kalna to the Rupnarain river.

(3) Old Damodar from Sure Kalna to Falta Point, and

(4) Rupnarain river to the Hooghly at Geonkhali.

Reach from Durgapur Barrage to Sure Kalna.

This stretch of the river is immediately below the important headworks namely Durgapur Barrage constructed by the DVC. In this reach is also situated the Anderson Weir which was built in 1931/32 for irrigating an area of approximately 200,000 acres, in the district of Burdwan. The river in this reach is very wide and more than a mile at many places. The river intertwines into channels forming a number of islands where vegetation is rampant.

In the beginning of the 19th century the river was embanked along both banks from a point about 20 miles below Durgapur. In the middle of the last century the right embankment was removed in places. The left embankment, however, was strengthened and maintained to protect the railways, the highways and the country-side.

There are a number of hanas taking off from the right bank of which, except two, all are uncontrolled. Generally, the flow in those hanas helps the people of trans-Damodar area in irrigation so long as the flood in the Damodar does not exceed 200,000 cusecs at Durgapur.

Kanke river from Sure Kalna to the Rupnarain river.

This is now the main channel of the river carrying the major share of the annual flow above bifurcation. The river channel seems to be in the formative stage. Lower down, it splits

itself into three channels - Harinakhal, Kabla Nala and Mundeswari, of which Mundeswari is the main channel. A number o smaller nalas take off from these channels and join again later in the downstream. The terrain of the country on both banks is generally flat. The area abounds in low pockets which get filled up with flood water; and do not get drained easily. T has resulted in limited cultivation.

Only the tail portion of this channel experiences tidal effects in the dry season, the tidal limit extending upto Baligori, 5 miles upstream of its outfall into the Rupnarain.

The western edge of the trans-Damodar area is also susceptible to flooding from the Darakeswar.

Old Damodar from Sure Kalna to Falta Point (Amta Channel).

There are a large number of outlets from the old Damodar channel leading into the adjoining area. These channels and outlets were formerly utilised for taking in water for purpose of irrigation, when there was little rainfall in the local areas. In case of local heavy precipitation these outlets and channels were again utilised for drainage purposes.

However, year after year the old Damodar course has been getting silted up, particularly near the bifurcation. At present the bed of the old Damodar within a mile from bifurcation is about 7 ft. above that at the bifurcation. A number of these outlets from bifurcation to Amta are choked up and are not functioning properly. There are reaches in the bed of the old Damodar which are low and have stagnant water pools. As the flow into the

old Damodar has reduced considerably, the irrigation and navigation facilities of this reach have suffered.

As the upland flow into the Amta channel from the Damodar got reduced by the choking up near the bifurcation, the tidal effect on the lower reaches took the upper hand. The tidal inflow coming up the Damodar from the Hooghly now meets the tidal inflow from the Rupnarain through the Ghaighata-Bakshi Khal below its junction with the Damodar; whereas around about 1940 the tides used to meet inside the Ghaighata Khal itself. The tidal inflow that is felt now at Amta is from the river Rupnarain through the Ghaighata Khal (Appendix - 8).

Rupnarain river to the Hooghly at Geonkhali.

The river after the confluence of Darakeswar and the Silai rivers is known as the Rupnarain river. Its flow is augmented by a number of channels from both banks, such as, the Mundeswari, Hurhur and Baksi Khals on the left and Mohankhali, Durbachatti on the right. All these channels join a few miles upstream of Kola Ghat Bridge and the river flows in a south-easterly direction to join the Hooghly near Geonkhali. These rivers being flashy, the flow into the Rupnarain which is limited to the monsoon months is subject to considerable fluctuations. During the remaining 8 months of the year, this river is entirely controlled by the tidal action, the river being tidal as far up as Ghatal, 52 miles upstream of Geonkhali, in spring tides.

The Rupnarain provides a magnificient reservoir for the reception of tidal water and absorbs about 50% of the Hooghly tidal inflow which at the maximum stage is of the order of

1,400,000 cusecs. The influence of this river on the Hooghly is evident from the wide and deep channel scoured out from its outfall at Geonkhali down to Kulpi, a distance of nearly 15 miles, as compared to other stretches of the Hooghly. While providing considerable spill area for the Hooghly, this river has very small tidal spill area of its own, being embanked on both sides except for that spill area provided by a number of open side channels draining into it.

An examination of the hydrographic surveys of the river carried out by the Port authorities since 1938 has revealed that the overall cubature of the river has remained the same between 1938 and 1954 (Appendix - 9). An examination of gauge readings at Gopigunge and Bandor at the head of the tidal prism of this river indicates a rising trend of dry season low water with a falling trend of the tidal range till about 1937. From 1937 onwards there has been no definite trend of rise of low water and fall in ranges.

A comparison of the surveys of 1938 and 1954 indicates that considerable changes have taken place in the regime of the river between the two constrictions at Geonkhali and at Kola Ghat. The right bank of the river in the vicinity of Tamluk has eroded for a length of 5 miles, the maximum width of erosion being almost a mile while the left bank in this reach has remained unchanged. It is because of such changes that there has been deterioration in navigation facilities. It is known that in the past considerable river traffic consisting of country boats

and launches drawing about 5 feet used to ply in this river. At present navigation downstream of Kola Ghat bridge is restricted by shallow crossings in the reach downstream of the bridge. Upstream of Kola Ghat, the river is shallow and only craft drawing 18" ply between Kola Ghat and Gopigunge.

A close study of the estuary model of the Hooghly at the Central Water and Power Research Station, Poona, was made. This has revealed that owing to the peculiar configuration of the river Hooghly, almost all the bed material goes into the Hooghly and the Rupnarain draws only the suspended material and part of the bed material thrown into suspension due to turbulence. This feature combined with the silt-free spill water from the Damodar has helped to keep this river in its present condition.

CHAPTER IV

POSSIBLE EFFECTS OF THE D.V.C. DAMS ON THE LOWER REACHES OF THE DAMODAR RIVER AND THE RUPNARAIN.

Reach below Maithon and Panchet Hill to Durgapur.

Considerable amount of silt is brought down the Damodar and the Barakar rivers, especially in the early part of the monsoon, most of which will be held back by the Maithon and the Panchet Hill reservoirs. Because of the fact that the monsoon storage capacity in these two dams is small compared with the monsoon runoff, (less than 1" in the case of Panchet and about 4½" in the case of Maithon as against a minimum runoff of 10"

in a dry year, 20" in an average year and 30" in a wet year), finer silt is not expected to be trapped in these reservoirs to the same extent as sand. The relatively sand-free water flowing over the spillways of these two dams will regain its charge by scouring the bed of the channel lower down.

There will be accretion upstream of the barrage for some years to come as is natural with all barrages and below the barrage the retrogression would start. After sometime, a balance would be reached; in fact, scouring downstream will stop and accretion will start. Normally such action of scouring and regaining takes only a decade or so in a river with considerable silt and sand charge. But here as the Maithon and Panchet dams will arrest practically all the coarser silt, the process of retrogression and accretion may continue for some years more.

Reach between Durgapur and Sure Kalna.

The relatively charge-free water released from Maithon and Panchet Hill may not regain the charge to the extent that it can carry in the reach between the dams and the Durgapur barrage, as a result of which the flood water below Durgapur would continuously pick up the silt and carry the same downstream. This will also lower the water levels in the river Damodar in a low stage and would deprive the trans-Damodar area along this reach from the periodical flushing and uncontrolled irrigation. The control of floods of the Damodar ensures a certain degree of protection to this area. The regulated perennial flow in this reach will provide assured water supply for domestic and municipal uses.

Because of the continuous supply of water below Durgapur, the bed of the river will retain enough moisture to help heavy growth of jungle, all along the river channel. Such growth obstructs the flood and also the silt. This has the effect of raising the river bed and increasing the hazards of overflow.

Though there will be a perennial flow in the river channel owing to the controlled releases down the river, the main deep water section of the river will have a tendency to shrink owing to complete cut off of the higher floods which the river had been occasionally carrying before the dams were built. This will tend to raise the flood level with a comparatively lower discharge and may cause overflowing of the right bank even for the controlled discharge of 250,000 cusecs. Consequently, the maintenance of the left embankment of the Damodar will require attention and vigil even with lower floods than at present.

Reach from bifurcation at Sure Kalna along the Kanke-Mundeswari river up to Rupnarain.

The bankful capacity of this channel (Kanke-Mundeswari) is at present of the order of 70,000 cusecs and even after the operation of the dams similar discharges are likely to pass down this channel.

The country-sides on both banks of this channel will continue to get periodical flushing even after the operation of the dams though the frequency and intensity of such flushing will be reduced (Appendix - 10).

Reach from bifurcation at Sure Kalna along the Old Damodar River to Falta Point.

After the DVC dams come into operation, the frequency and intensity of floods at Rhondia will be reduced.

Regarding navigation, irrigation and drainage, there will be no appreciable change from the existing condition. On the l ft bank, however, irrigation facilities are being provided by the DVC from their new canal system. It is, however, certain that owing to the reduced frequency of the regulated flood flows, the extent of flushing which this river is getting at the present will be reduced to some extent.

The stretch from Amta to the junction of Ghaighata-Baksi Khal with the Damodar will not be affected. At present, a hump is reported below the junction of the Ghaighata Khal with the Damodar. The present tendency of this hump to increase will be accelerated with the reduction of Damodar flushing. The Damodar channel below this hump has been deteriorating. With the reduction of this flushing, the rate of deterioration is likely to be accelerated.

Rupnarain to the Hooghly upto Geonkhali.

After the DVC dams come into operation the frequency of high floods will be reduced, whereas the duration of low discharges is likely to be increased.

This continuous moderated flow will be helpful in maintaining the navigable channel down the Rupnarain to its junction with the Hooghly; whereas the reduction of peak flows is likely to reduce the present flushing effect of high floods.

CHAPTER V

SUGGESTIONS REGARDING THE STEPS TO BE TAKEN FOR PREVENTING DETERIORATION OF THE LOWER DAMODAR & THE RUPNARAIN.

1) Encroachment on the river by private interests must be prevented by suitable legislative and other measures.

2) The growth of vegetation in the bed of the river and also along the bank should be carefully watched and suitable action taken so as to cause minimum obstruction to the flood flow, frequency of which would be definitely less than what it is now. Controlled cultivation above normal high flood level and in chars will be helpful in restricting jungle growth.(Reference page No.8).

3) Concentrated flushing doses should be occasionally released down the river in the interest of the conservancy of the river channels. Proper studies should be made while releasing the flushing doses as to the effect of such operation on the regime of the river as well as on the various interests on the banks. Such studies would be of valuable guidance for future operation of the reservoirs.

4) In fixing the priority of water uses the conservancy of the river channel itself must not be ignored and should be given due consideration along with other uses of water viz., irrigation and generation of power. The operation of the reservoirs should be flexible enough in the initial stages, so that a proper and careful study can be made and suitable adjustments in the plan of operation are introduced for the benefit of all concerned.

5) Some suitable method of supply of irrigation water for the trans-Damodar area may be investigated.

6) The problem of drainage of local area in the lower valley should be separately studied and investigated and suitable action for drainage of these areas should be taken up by the appropriate authorities.

7) Detailed investigations should be carried out to effect improvement over the present condition of the Amta channel. Care should, however, be taken to ensure that it does not affect the river Rupnarain adversely.

8) Immediate and suitable steps should be taken for carrying out systematic hydrological investigations and observation in this area (Reference page Nos. 6 & 7).

9) It is well-known that several problems arise in the lower reaches of the river after construction of the dams. In the present case the problems are further complicated by the tides in the lower reaches. It is, therefore, difficult to forecast the actual problems that would crop up in this area after the completion of the Damodar Valley Project. It would, therefore, be necessary to have a proper control so as to co-ordinate the activities of the different authorities concerned.

We suggest that a Board to be called the "Lower Damodar Conservancy Board" be set up with the representatives of the Government of West Bengal, Calcutta Port Commissioners and the Damodar Valley Corporation. The function of this Board will be :-

(a) to formulate the necessary hydrological and engineering investigations that will have to be carried out to study the effect of operation of dams especially the releases during the floods;

(b) to suggest alternative plans of operation, if any, and

(c) to formulate schemes for improvement of channels and any local area in the lower valley.

It is necessary to have a proper unified development of the entire lower valley as a whole instead of solution of individual problems for local and short-term benefits.

ACKNOWLEDGEMENTS

Throughout our visits and enquiries we have received considerable assistance and co-operation from the officers and staff of the Damodar Valley Corporation, the West Bengal Govt. and the Port Commissioners. We are indebted to all of them.

We regret very much for the delay in submission of the report but as pointed out earlier, lack of data has been a definite handicap to our work.

(G. R. Garg) --- Chairman.

(N. K. Bose) --- Member

(G. B. Mondal) --- "

(A. L. Das) --- "

(S. P. Sarathy) --- "

Anderson House, Alipore
Calcutta-27.

March 4, 1957.

(D. Mookerjea) --- "

(N. S. Iyengar) -- Member-Secretary

DAMODAR VALLEY CORPORATION

REPORT OF THE LOWER DAMODAR INVESTIGATION COMMITTEE

VOLUME II
(APPENDICES)

Calcutta
March 1957.

Appendix 1.

DAMODAR VALLEY CORPORATION
ANDERSON HOUSE, ALIPORE
CALCUTTA

No. WI-G/21-1880 February 24, 1955.

MEMORANDUM

Sub: Lower Damodar Investigation Committee.

From time to time some misgivings have been expressed by a section of the public as to the possible effects of the DVC dams on the lower reaches of the Damodar river and the Rupnarain. The Corporation has, therefore, decided to appoint a Committee to be known as "Lower Damodar Investigation Committee" under Section 10 of the DVC Act consisting of -

1. Sri G.R. Garg, ISE - Chairman
2. Sri N.K. Bose, Director, River Research Institute, Government of West Bengal.
3. Sri G.B. Mondal, Consulting Engineer, Irrigation and Waterways Department, Government of West Bengal.
4. Sri S.P. Sarathy, Assistant River Surveyor, Commissioners for the Port of Calcutta.
5. Sri D. Mookerjea, Project Manager, Barrage & Irrigation, DVC.
6. Sri H. J. Ajwani, Planning Engineer, DVC - Member Secretary.

2. The functions of the Committee will be -

(a) to examine in detail the available data and suggest what further information will be required with respect to the regime of the Lower Damodar river and the Rupnarain;

Cont'd...

Report of the
Lower Damodar Investigation Committee

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(b) to assess the possible effects of the DVC dams on the lower reaches of the Damodar river and the Rupnarain;

(c) to suggest what steps, if any, should be taken for preventing deterioration of the Lower Damodar and the Rupnarain; and

(d) to make such other recommendations pertinent to the subject which they may consider necessary.

3. The Committee will meet as often as is necessary, the meetings being arranged by the Member Secretary.

Sd: P.C. Acharji.
Deputy Secretary.

Distribution:

1. Sri G.R.Garg,ISE, Special Commissioner for Canal Waters, Government of India,Ministry of Irrigation & Power, Curzon Road Barracks, New Delhi.
2. Sri N.K.Bose,Director,River Research Institute,Govt. of West Bengal, Anderson House, Calcutta-27.
3. Sri G.B.Mondal,Consulting Engineer, Irrigation & Waterways Department, Government of West Bengal, Anderson House, Calcutta-27.
4. Sri S.P.Sarathy, Assistant River Surveyor,Commissioners for the Port of Calcutta,15 Strand Road, Cal.-1.
5. Sri D.Mookerjea,Project Manager, B&I.,DVC, Calcutta.
6. Sri H.J. Ajwani, Planning Engineer, DVC, Maithon.
7. The Secretary to the Government of India, Ministry of Irrigation & Power, New Delhi.
8. The Secretary to the Government of West Bengal, Development Department, Raj Bhavan, Calcutta.
9. The Secretary to the Commissioners for the Port of Calcutta, 15, Strand Road, Calcutta-1.
10. The Chief Engineer, DVC, Maithon.

Appendix 2.

Preliminary Report of the Lower Damodar Investigation Committee.

1. We, the members of the Lower Damodar Investigation Committee, constituted under D.V.C. Memorandum No.WI-G/21-1880 dated February 24, 1955, assembled for the first meeting at Anderson House on 28th April, 1955.

2. Terms of reference of the Committee were discussed and it was decided that for proper appraisal of the problem, local inspection of the Valley should be made. Accordingly, the outfalls of the Damodar and the Rupnarayan into the Hooghly, including a portion of the Hooghly river were first inspected. Thereafter Maithon and Panchet Hill dams, Durgapur Barrage and canal works, Anderson Weir at Rhondia, left embankment of the Damodar from Silna (Mile 0) to Sadarghat (near Burdwan, Mile 21), Hanas opposite Sadarghat and the spill areas on the right bank were inspected.

3. Subsequently, inspection of the stretch of the Damodar river from Dhapdhara (mile 43) to Amta (mile 79) was carried out. The bifurcation of the Damodar at Muchi Hana and Begu Hana through which the main flow of the Damodar is carried to the Rupnarayan River was also inspected. This was followed by a visit to the trans-Damodar area from Champadanga to Arambagh, crossing the Mundeswari and other channels, which carry the main discharge of the Damodar at present.

4. Some of the hydrological data collected by the members of the Committee were examined. It was understood that some more data, especially on cross-sections and gauge-readings, for different reaches of the river might be available in the old records of the Irrigation Department of the West Bengal Government. It was suggested that the details pertaining to the artificial cut through the Muchi Hana might be obtained from the District Gazetteer and other records.

5. On the data made available to the Committee, we are of the opinion that, in view of the complicated nature of the problem, which was forcefully brought to our notice during the visits, it will not be possible to make specific recommendations to the Corporation on the terms of reference (b), (c) & (d), until the following further data are collected :-

(i) Plane-table and contour survey of the area covered by the bifurcations of the Muchi Hana and Begu Hana from the Damodar. This was also recommended by the DVC Board of Consultants in 1951. (Hitherto cross-sections of the channels below the bifurcation have been taken.)

(ii)

(ii) Three cross-sections of the Damodar river at Amta and Champadanga from left embankment to 1,000 ft. beyond the right bank of the channel at 1,000 ft. intervals.

(iii) Three cross-sections of each of the channels distributing the discharge of the Muchi Hana should also be taken at 1,000 ft. intervals nearabout the points of their inter-section with the Champadanga-Arambagh Road; these cross-sections should extend 1,000 ft. beyond the defined banks.

(iv) Gauges and discharges should be recorded at Muchi Hana and Begu Hana bifurcation points as detailed below:

(a) Upstream of Muchi Hana bifurcation point;

(b) Muchi Hana itself, before its junction with Begu Hana;

(c) Main Damodar below the bifurcation of the Begu Hana;

(d) Begu Hana;

Some work in this connection is already being done since 1953.

& (e) Gauges and discharges at the points mentioned above in 5(iii).

(v) Old cross-sections and gauge readings at as many sites as available in the reach below Durgapur should be collected from the Irrigation and Waterways Directorate.

(vi) Fresh cross-sections should be taken at the sites where the old cross-sections are available.

(vii) Reconnaissance survey by air of the river stretch from 5 miles upstream of Durgapur to the outfall of the rivers into the Hooghly at Fulta point and Geonkhali. This reconnaissance is proposed to be undertaken by the Committee during the next meeting in October 1955.

(iii)

(viii) Aerial photography of the above area (to a scale of 2" = 1 Mile, to be enlarged to 4" = 1 Mile) extending to 10 miles on the left bank of the Damodar and 10 miles to the right bank, covering the entire drainage area. This survey will not only be useful for the present study, but also for any model experiments that may be found necessary in the future. It will also form a very useful record of the present (pre-dam) condition of the river channels for any reference in future.

(ix) The problem of sub-soil water-table also needs investigation, but we understand that a separate Committee of the Corporation is already dealing with this problem.

6. In view of the fact that the Damodar dams will come into operation very soon, we consider it imperative that the collection of the above data should be undertaken before the next monsoon, so as to assess the conditions likely to develop in the lower valley in the future. Great stress is laid on the accuracy of these data and it is suggested that this work should be carried out under the close supervision of a responsible officer. This officer should collect the data, sift, analyse, and place them before the Committee next October.

7. We consider it necessary to inspect the working of the Hooghly models now in operation at the Central Water & Power Research Station at Poona. This, we propose to do next October.

Sd:
(G.R. Garg) - Chairman.

Sd:
(G.B. Mondal) - Member.

Sd:
(N.K. Bose) - Member.

Sd:
(S.P. Sarathy) - Member.

Sd:
(D. Mookerjea) - Member.

Sd:
(H.J. Ajwani) - Member-Secretary.

Appendix - 3.

Statement showing the H.F.L. and L.W.L. of the River Damodar near Amta Gauge together with the average Sectional area at the site.

Year	H.F.L. (P.W.D.-Datum)	L.W.L.	Average Sectional area.	
1929	21.70	4.00	---	
1930	21.80	6.00	4,879 Sft.	The average Sectional area has been calculated below 20.00 P.W.D.
1931	19.30	7.19	4,980 "	
1932	19.80	5.53	5,100 "	
1933	22.00	5.79	4,622 "	
1934	20.10	5.75	4,652 "	
1935	21.60	4.90	4,369 "	
1936	21.90	5.00	4,302 "	
1937	21.90	5.60	4,278 "	
1938	19.30	5.30	4,366 "	
1939	23.67	5.50	4,140 "	
1940	21.50	5.10	4,012 "	
1941	22.00	5.00	3,064 "	
1942	21.90	5.40	3,833 "	
1943	22.30	5.40	3,620 "	
1944	22.10	5.40	3,779 "	
1945	17.10	5.00	3,180 "	

Cont'd.....

(ii)

Year	H.F.L. (P.W.D.-Datum)	L.W.L.	Average Sectional area.
1946	23.83	5.50	3,620 Sft.
1947	21.80	5.50	3,432 "
1948	21.10	5.10	3,564 "
1949	20.50	5.70	3,373 "
1950	23.2 9	5.80	3,265 "
1951	21.90	6.00	2,635 "
1952	20.40	6.30	3,401 "
1953	22.25	6.50	3,840 "
1954	21.70	6.00	3,042 "
1955	16.60	8.20	3,109 "

Appendix - 4.

ARAMBAGH (PRABASI) GANATANTRIC SANGHA.

Secretary -
Radhanath Ghosh.

12, Kali Dutta St.
Calcutta-5.

Ref.....

16.5.1955.

Mr. H.J. Ajwani,
Planning Engineer D.V.C.

Secretary,
Lower Damodar Investigating Committee,
Anderson House,
Alipore
Calcutta.

Dear Sir,

I append for information and kind consideration an extract from the resolution adopted in a conference of the people of the districts of Hoogly, Howrah, Burdwan, Bankura and Midnapore under auspices of the Arambagh (Prabasi) Ganatantric Sangh, Khanakul Thana (Hoogly) Pally Unnayan Samity, Burdwan Sanmeelani, Bankura Sanmeelani, Tarakeshwar Railway Extension Committee, Hoogly District Association, Howrah Unnayan Sangh and Midnapore Sanmeelani, held at the Mahabodhi Society Hall, Calcutta on 8th May 1955 under the presidency of Dr. J.C.Ghosh, Vice-Chancellor of C.U. and newly appointed member of the Planning Commission, Government of India:

In order to allay the difficulties and troubles of hundreds of thousands of the residents of the Hoogly, Howrah, Bankura, Burdwan and Midnapore districts which they experience daily in maintaining contact with Calcutta, the nerve centre of West Bengal, even now in the eighth year of our independence, the meeting demands :

"I. Extension of rail roads between :-

i) Santragachi and Bistupur (via Radhanagar and Kamarpukur).
ii) Tarakeswar and Bistupur (via Arambagh)
iii) Mechada and Digha (via Tamluk-Kanthi) and electrification of the Calcutta Kharagpur section of the Railway.

(ii)

II. Reclamation of :-

i) Darakeswar, Shilavati etc., rivers by construction of Bunds and Reservoirs maintaining the waterflow of Damodar by necessary drainage and then making navigable waterways on Rupnarain.

ii) Re-excavation of Kaki-Mundeshwari - Kana Darkeshwar River.

iii) Joining the Aurora and Salalpur Canals.

III. Reconstruction and maintenance of Bainchi-Kalna-Ramkrishna Road (Burdwan).

It is requested that necessary action be taken to implement the above suggestions through the next 5-year planning or otherwise.

Yours faithfully,

Sd: Radhanath Ghosh.
Secretary.

Appendix- 4.

Paper cutting from Swadheenata dated 9th May 1955.
(English translation of the Bengali version).

Four thousand bighas of land in the region of Damodar River in the district of Howrah lying uncultivated.

District Farmers' Association demands immediate irrigation facilities.

Howrah, 8th May. It is reported that in Howrah district the condition of the river Damodar is becoming worse day by day. During the whole of the year water flows only for three or four months. Excepting these four months, condition of the river has become such that the bullock carts and men on cycles can easily go right across the river from Amta to Mahisrekha through Bagnan without a least difficulty. In thousands of bighas of land, on the bank of the river, Rabi & jute crops used to be cultivated in sufficient quantities and these were the principal cash crops of these lands. Since last year, as the river has silted up, the yields of this land which used to fetch several lakhs of rupees have totally been stopped and the cultivators are now faced with a new crisis. Apart from this, rivers Damodar and Rupnarain are connected by Gaighata Khal. But due to the absence of flow in the River Damodar, the eastern junction of Gaighata Khal is silted up so badly that normal river-borne trade with the districts of Howrah, Hooghly and Midnapore has been facing a complete collapse. Wholesale transactions in the Bakshi Bazar which is the biggest business centre in Howrah is nearly stopped. The course of the Rupnarain River now flows towards the northern direction Amta from the mouth of the Gaighata Khal. Even the peak tidal flow does not reach Dabkhantina - Shyampur which is at a distance of only 12 miles from the mouth of the Gaighata Khal. In some places, last year the cultivators with their own initiative tried in vain to imporve the condition and they are very much disappointed this year.

This statement has been given by Sri Amal Kumar Ganguly, Vice-President, District Farmers' Association, demanding from the State Govt. immediate implementation of the plans regarding suitable irrigation arrangement and improvement of waterways in these localities of the Howrah district.

- Reporter -

Appendix- 4.

K.C. Banerjee
I.S.E.(Retd.)
Chartered Engineer (Ind).

Calcutta.
12.12.54.

To
Sj. Gulzarilal Nanda,
Hon'ble Minister Indian Union,
New Delhi

Dear Sir:

I am writing this letter in response to your call for assistance from retired engineers I being one of them. I was responsible for design of the Topchanchi dam of Jharia Water Supply and was its consulting engineer some time during its construction. This was the first masonry dam constructed on this side of the country. The watershed area of this dam consists mainly of forest standing on almost exposed rock. Even under this condition, I hear that the tank has been silted up to a certain extent.

I wrote a paper some time in 1950 on D.V.C. Scheme and other cognate matters concerning West Bengal, an extract from which is enclosed herewith for your information. I have been sceptic since its inception. This scheme robs Peter and gives this robbery to Paul. It deprives the country alongside the banks of the Damodar in the districts of the Hooghly and Howrah of its legitimate flood water (they were getting free of cost) renewing the soil every year and thus maintaining them in normal fertile condition year to year. The yield from these land will deteriorate year to year after the completion of the project. The scheme will also make these places more malarious than now. The scheme will also deprive the Hooghly river (which is a dying stream), of its principal tributaries and this will make it a dead stream even before the Farracks Barrage is constructed. I wrote in paper the life of the scheme would not likely to be more than 10 to 15 years not 100 years and will have to be scrapped before it is completed because the tanks will be filled up with sand. The last silt deposit experi-carried out by D.V.C. staff as published in papers conclusively prove my assersion. The scheme for soil preservation of such big watershed area is hardly a feasible proposition; I affirm this from my intimate knowledge of the country. I am almost convinced that the useful life of these works will never be outside 10 to 15 years. If this happens, God forbid, it will be a national calamity. My remarks regarding its estimate may be seen in the extract. If the Damodar Scheme fail, instead of preventing flood it will create such disastrous flood the like of which was never known in history of the province. With regard to renovation of Hooghly river according to some experiments that are being carried out

in Hydraulic Research Laboratories I frankly say that I have got no faith in it as the hydraulic condition of the river will be entirely different when Damodar Project is completed. The Calcutta port will have to be maintained by dredging and by more expensive process than now done.

I cannot express opinion with regard to other similar projects or flood prevention schemes as I have not got enough of information to do so. I only wish in these matters the important function of flood in replenshing the depleted soil ingredients would be carefully considered. The crops produced in a land are not composed entirely fertilizers added the mineral ingredients of the soil form the major part of them. These ingredients are replenished by the only natural process of flood and otherwise they will be exhausted

If I am of any help to you, I shall be glad to offer.

Yours faithfully,

Sd: K. C. Banerjee.

Enclo: An extract from 'Some Post-partition Problems, in Urban and Rural West Bengal' by K.C.Banerjee.

(iii)

The Hooghly River, the backbone of health and comfort of West Bengal and the main stay of the port of Calcutta is admitted by everybody to be in decandancy. The deterioration of this river received attention of the Government even in the middle of the last century. More recently in 1910, this matter was particularly brought to prominence by Major Hurst and a committee known as Stevenson-Moorre Committee was appointed for further report after investigation. They come to the conclusions that though the deterioration had started the rate is not such as to cause alarm then or in the near future. They, however, recognised the immediate necessity of augmenting the perennial flow in dry months. After this, the subject was shelved and nothing was done to improve the condition of the river regime. This matter again received attention of the public sometime in 1936 when owing to the rapid decandence of the stream backishness of the river water at Palta Head Works started rapidly increasing but unfortunately no serious attempt was made to remove the difficulties.

Like all mortals on this earth, rivers are born and they live and die and cannot escape this natural law. But the lives of rivers like other mortals can be shortened or prolonged in manifold ways. The life blood of this sacred stream is being taken away by canal systems in United Provinces and Bihar; this is the root cause of the morbund state of the Hooghly. Man in his empty pride inspired by an overweaning conceit of personal attainments and ability often does things, the evil consequences of which is felt in a distant future. The regimen of stream remains unaffected as long as the intensity and duration of flood consequential to uniformity, duration and distribution of storage, throughout its length do not materially vary and thus the capacity of flow to carry water-borne silt remains almost the same. A slight variation of these factors can be made up by the flushing effect of the almost silt free flow during the dry weather. This latter flow must be of sufficient volume to restore regime to its original natural condition by removing the silt deposited due to deviation of flood.

The Hooghly river has lost all these essential factors necessary for the sustenance of continuous natural course. The Hooghly river comes out of the main Ganges stream near about Dhulian where the opening at times is said to be about 70' x 5' in cross section. This opening of 210 sft. area supplies the entire flushing water of our river during dry months. This will appear to everybody to be ludicrously small; it cannot maintain any stream in its natural course far less the river Hooghly which receives an unprecedented silt-laden water from its tributaries in wet weather. The drainage from the Chotanagpur and the Santhal Parganas ceases entirely in dry months and along with it the three spillways - Ichamoty, Jalangi and Mathabhanga cease to contribute anything to increase the flow in the Hooghly.

(iv)

To resuscitate the Hooghly, the first thing, besides the dredging of sandbanks and bare (an essential) operation for tidal rivers below the port of Calcutta to be done, is to adopt adequate means by which the dry weather flow the mouth near Dhulian is sufficiently increased to flush out as much as possible the sand deposited in the river bed. In 1940 Sri S.C.Chakravarty the then Executive Engineer, Calcutta Corporation Water Works after inspection of the locality reported 'I think it would be agreed on all hands that the best course to keep the Bhagirathi alive is to open a new cut from this point (Sibnagore)'. Where the river was 90' deep, he estimated that the opening of this passage would cost Rs. 3,000,000. The carrying out of this scheme or any scheme on this line will prevent to a considerable extent the sand and silt from being pushed upwards and downwards with the tides; of course satisfactory results can only be obtained if the force of dry-weather flow can be made sufficiently strong, for this purpose. Any inaction on account of despair and despondency is likely to do more harm than good to the province. I understand that there is a proposal for the construction of a barrage somewhere in the Ganges to bring more water in the Hooghly to improve the regime of the Bhagirathi and its dry-weather-flow, but it is an expensive scheme and will take very long time to materialize and complete and by the time the project is started the regimen of the Hooghly river may reach an irretrievable condition. This therefore should receive the immediate and serious attention of the Provincial Government. Larger flow in the Hooghly will also dilute the sewage and other effects matters and thus improve its sanitary condition to an appreciable extent.

To get rid of sewage and industrial wastes being discharged into the river there should be two complete combined sewerage works one on either side of the strata, for all the Riparian Municipalities upto Halisahar on the East Bank and Bansberria on the West Bank. The sewage will be received into sewere through water flushed numerous public or common latrines in each municipality and conveyed to a common outfall works where it will be treated by some upto date method. These works may produce sufficient gas to run the pumping and treatment of plants and all their accessories. The manures produced from these disposal works will be of considerable value. Two combined water works for these Municipalities are also necessary to supply water required for conveying and flushing sewage, admitted into the sewers. As scheme on these lines was prepared in the early part of this century but was shelved owing to the change of Ministry. If these works are carried out, not only a healthy abode will be created for the aquatic animals but also I believe fish supply from the river will be immensely increased. This will reduce at any rate very considerably

the danger of communication of diseases by water-borne organisms to the people living on the banks and using river water for various domestic purposes. The late Sir Surendra Nath Banerjee then a Minister in Bengal, induced the Jute Mill Association which was principally responsible for the present condition of our river to contribute, if I remember aright, Rs.100/- per loom for the promotion and execution of schemes for the prevention of pollution. From a part of this fund two upto date sewage purification works were carried out. With his departure from the then Executive Council every thing fell through and nothing has been done since then.

The combined water supply for Municipalities in the Eastern Bank, which I worked out was found to be economical and the loan floated for financing it could be repaid in 20 years at the then bank rate of interest. The supply cost was found to be considerably cheaper. At present these mills supply water for the municipalities and the municipalities in lieu of which forego their local water taxes leviable under the Bengal Municipal Act.

Urgency of such schemes is becoming more and more incontrovertible necessity as we are fast approaching a time when the labour now employed in public health conservancy works will surely refuse to perform any unclean works. The conservancy works in rural areas will also have to be carried out in a way different from the one now in practice.

Besides this there are other factors which have contributed to the scarcity in fish supply in the new province of about 1,200,000 acres of upland water source for fresh water cultivation of fish more than half remain dry during the winter months of the year. The remaining portion is filled up with water-hyacinths or other vegetation either submerged or floating require expensive arrangements for culture and development. Until and unless proper arrangements are made for cleaning these obnoxious growth there can hardly be any possibility of making the province self sufficient in fish supply. The riverine supply cannot be developed until the dying rivers of West Bengal are brought to life by renovating according to a development plan.

It is also argued that owing to the partition, West Bengal has become short of fishermen but I believe there are sufficient number to meet the requirements of the province.

(vi)

But the real difficulty is that owing to the denial polity of the late Government during the latter part of the last World War large number of fishing boats belonging to fishermen were destroyed and the fishermen were forced to take other occupations for their subsistence, subsequently the abnormal rise in prices in yarn for nets, timber and nails etc. for boat building and also the extreme scarcity of these and other requisite materials used in fisheries have prevented them from reverting to their hereditary profession. In this matter it behoves the Govt. to make a free gift of fishing boats, nets etc. to the fishermen for the destruction of which the administration was responsible or to sell them at very low price recoverable in 5 or 6 years time to give inducement to these people to return to their own profession.

(vii)

DAMODAR VALLEY MULTIPURPOSE PROJECT

This project has been subject to discussion in many quarters, viz., in the Union Parliament, local assembly and in almost all newspapers. This scheme like many other schemes in this country has been drawn up by foreign experts who promised results producing utopian conditions in Bengal and Bihar in the fields of economy, health, agriculture, trade, commerce and communication etc. I wished I joined them in their chorus of praises but unfortunately I have been always throughout my life a pessimist with regard to paper schemes and look on the dark side of things, and my pessimism of ten in the past proved almost everywhere to be correctly founded.

The scheme promises chiefly the following results :-

1. Complete control of Damodal flood and thus saving the country lying on its banks from deluge and devastation.

2. Bringing many hundreds of square miles of barren lands under irrigation thereby producing large quantities of food-grains so badly wanted for our subsistence.

3. Generating by hydro-electric process a considerable amount of electrical energy which when utilised in new industries and communications will increase the wealth of the province and improve the condition of labour by giving them increasing opportunities for employment and obtaining good wages.

4. It will provide for adequate and purer water supply to villages and towns in the areas under command and thereby improving the sanitary conditions of the country.

5. This will provide for necessary water for anti-malarial flood-flush schemes and the existing stagnant and moribund channels will receive sufficient water for flushing.

6. Lastly, it will provide for a navigation canal connecting the coal fields and Calcutta Port through the Hooghly.

On theoretical consideration as far as one can judge the report published, the above results can reasonably be expected. The proverb goes, however, that an ounce of practice is worth more than tons of theory.

The principle of design is stated as follows :- "In the determination of maximum flood for which provision should be made, the principle was followed that in complete flood

protection i.e., flood protection for medium floods without protecting against the largest possible flood is understandable. The semi- protected area will be built up and a flood larger than that for which protection was provided did occur, the damages and loss of life would be far greater than if no flood protection were at all provided." This is quite sound and the apprehensions stated therein are perfectly right and reasonable.

The storage capacities provided if no unforeseen things happen should be ample to meet the requirements. The greatest unforeseen event that is likely to happen is the silting of reservoirs and thereby rendering the whole scheme valueless and bringing ruin and destruction to the people living under false security and also embarassment to the Govts. financing the scheme.

To meet this danger the designer of the project relies entirely on the 'dead storage capacities' of reservoirs which is expected on the basis of observations made between 1939 and 1941 to be filled up with silt in about 80 to 100 years. Observations made during the above three years at Barhi that the average silt carried by the Barakar river amounted to 1/350th part of the average flow. The Barakar river has a steeper basin consequently the volume ratio of the silt carried by this stream must be greater than the average volume ratio of the silt carried down by all the streams taken together from the entire watershed area. This ratio has been assumed to be 1/500th part of the monsoon flow. A certain percentage of this will no doubt pass through the sluiceways of different reservoirs and thus increasing their effective silt storage capacities and the life of the scheme. These assumptions cannot be disputed. It is stated in the report that on the basis of this computation (1/500th part of the monsoon flow) it will take approximately 80 years for the dam (storage of the reservoir) to be filled up with silt.

In this connection it will be desirable to note the characteristics of the Hooghly and Damodar River of West Bengal.

As is usually the case, the physical characteristics of the greater part of the province have largely determined the course of these rivers. Ganges originally on entering Bengal found its way to the sea by flowing along the bed of the Bhagirathi and Hughly. As these channels gradually silted up the main stream unable to deflect, westwards owing to the rocky barrier of the Rajmahal hills out its way towards the east through the soft, loose soil and thus forming Ichamati, Jalangi and Mathabhanga in turn. Ultimately it found an outlet by the present channel of the Padma. The Damodar on the other hand rising in Chotanagpur and passing through hill range of Rajmahal in the district of Santhal Parganas and through West Bengal enters into Hooghly before it falls into the sea. The Damodar

has got a length of 368 miles and drains altogether 2,500 sq.miles of land. Its watershed above Rhondia is about 1070 sq.miles. Its maximum discharge in monsoon months varies from 36,500(1943) to 13,600 (1935) cusecs and in dry weather the maximum discharge varies from 2970 (1936) to 289 (1935) cusecs. It is liable to sudden flood for which it is famous. There were devastating floods lately in 1913, 1917, 1935 and 1943.

The original Damodar Embankment scheme was carried out for the protection of the arterial road and railway communication of India on its east bank, and also to prevent inundation and devastation of the country lying on both sides of the stream. This scheme was found to be very satisfactory during the first fifty years of working and rendered all possible protections for which it was projected. During this period the deposition of silt in its channel in its lower reaches i.e., in portions of its course through the comparatively flat country, was continuously taking place thereby reducing its cross-section below the working level. In consequence of this the flood protection became more and more inefficient and the result was a periodical incidence of flood and devastation. To increase the flood carrying capacity of the stream below working level the embankment on the west side of stream was allowed to be demolished. This arrangement gave relief for a certain number of years but ultimately with continuous rise of bed on account of silt deposit proved to be of no consequence. By throwing away the embankment on the right side the cross section of the flow must have been enormously increased and there was corresponding lowering the level of high flow. But at the same time the velocity of the flow was possibly considerably reduced and thereby increasing the rate of silt deposit in the bed and resulting in the raising of its level more rapidly than before; in my opinion this measure was wrong. Instead, such steps should have been taken that would have produced according velocity and lowered the bed of the stream. There are several ways of doing this which need not be discussed here.

In arriving at a correct estimation of the silting the following should be carefully considered.

1. Is 1/500th of the volume of monsoon flow on the basis of observations made during three successive years 1939-41 a correct assumption ? In the absence of detailed information with regard to observations made it is very difficult to express any opinion. The analysis of a few random samples during different hours of the day may be misleading and not decisive. The volume of silt carried by a stream varies very rapidly at different moments of the duration of flood and also at different depths of flow and lastly greatly according to the shape and configuration of the channel at the place from which the samples are collected. It is doubtful if dependable data can be obtained within a period of observation at one place even for three

consecutive years. However it is hoped that this approximation on which depends the duration of the serviceable life of the scheme is correct.

Technically speaking the storage capacities of all impounding reservoirs are of two classes according to the level of storage, viz. (i) useful or effective capacity (ii) dead storage capacity. The former is the storage capacity between the top working water level and the lowest draw-off level of the reservoir.

The dead storage capacity is the capacity below the lowest draw-off level which can be utilised for silt accumulation. The volume of this holding space varies according to the surface configuration of the site of the reservoir and also the lowest working level. Generally speaking, it is not in any way proportionate to the total storage capacity of the tank although some adjustment can be made by manipulating the position of its lowest working level. It is stated that the total volume of this dead storage of all tanks proposed in the valleys of Barakar and Damodar taken together will hold silt that is to be deposited in 80 years on the basis of the above approximation. From this, it is gathered by implication that the scheme is based on the supposition that the rate of deposit if silt will be almost the same or uniform in all the reservoirs and the consequent loss of storage in these parts will be on average almost equal. This part of the assumption, is highly problematical and in the working of the scheme a very wide deviation will be experienced. My firm conviction is that the Damodar stream will not be obliging as to deposit silt in proportion to the head storage capacities of different reservoirs that will be provided and also at a uniform rate in all reservoirs.

For intervention of a lake in the course of a river invariably makes it on entering at the upper end deposit and all the materials with which it is charged in the still waters of the lake. The river issues at the lower end as a perfectly clear stream with regular discharge (as illustrated by the river Rhone & Swine & c.) because in the flowing through the lake are spread over a large water surface and the resultant velocity is thus considerably reduced as the power of a current to transport material varies approximately as the square of its velocity, so it is not improbable that some of these tanks may get silted in one or two years, like the old New York dam which was silted up within one year after its completion.

Without going into further details I intend to conclude this part of the paper after setting down my apprehensions. I must state at the outset that I should not be taken as an expert and my inferences as infallible. They are open to revision and correction but should receive due attention to the authorities concerned.

(xi)

MY APPREHENSIONS

1. In England at least, whenever a dam is thrown across a stream, a certain portion of the normal flow is allowed to continue below the dam site as compensation water to people who lives below and has thus acquired their easement right, i.e. right to the uninterrupted flow of the stream enjoyed by them for generations together; as far as I can gather, in this scheme no compensation water appears to have been provided. All the discharge from the watershed will be bunded up by dams thrown across the streams. On account of this, two inevitable consequences are likely to come out. A considerable portion of the country especially in the districts of Burdwan, Hooghly and Howrah will be deprived of the water required for their cultivation and domestic purposes and the produce of the cereals in the regions will be considerably decreased. The course of the river in this part of the country will gradually produce a conditionalmost similar to "Adi Ganga" or "Tollys Nullah". There will also be a considerable increase of incidence of malaria epidemic in this area like those alongside the Tollys Nullah. How far this scheme will help in removing malaria in other parts is not also certain. Midnapore canal has made the district more malarious. Gomoh, once a health resort for many people, has become malarious after the construction of Topchanchi dam. Similar instances are not wanting in other countries.

POWER GENERATION:- It is stated "Electric Power Generation Station" has been planned in all dams. The total capacity of all hydro electric stations put together will be about two lacs kilowatts. As the amount of this power will vary in different periods of the year a thermal electric station with an installed capacity of 1,50,000 kW will be built. The hydro-stream combination will meet most of the load requirements in South Bihar and South West Bengal. Preliminary estimates indicate that the energy will be available for sale at very attractive rates.

If the scheme is successful and does not present any difficulties while working, perhaps these results may be obtained. But the greatest snag in this enterprise is the market condition now prevailing in India; amidst and Damocles' sword of nationalisation of industries hanging over the heads of investors, the high level of taxation and lastly the ever increasing demand of higher wages and 'going slow' attitude in production of labour; I believe, on these accounts of capital will be very slow to take up adventurous new concerns and industries, and if any advancement is made at all it will be very slow and gradual. The consumption of electricity will take no doubt 15 to 20 years to reach anywhere the estimated load, i.e., not before the time stipulated for the repayment of loan from the International Monetary Fund.

(xii)

All the irrigation projects thereto undertaken in Bengal and Bihar have been so far unproductive; I think the loan from which the Anderson anicut scheme has been executed has not been repaid as yet. It will probably have to be written off if that has not been done already. The Damodar Project scheme is, I understand, being financed by loan from I.M.F. If it proves unproductive, how and who will repay the loan, it is not known.- Bengal or Indian Union. During studies of data on which the rural development act (with which I was associated) was based, I came to learn the reasons why the farmers dislike a levy on account of the supply of water from irrigation canal. Generally speaking the rainfall in this province is so distributed that no difficulties arise for rice cultivation. Ordinarily they do not require any water for irrigation. But when this distribution of rainfall is disturbed by vagaries of weather, they do not get water in right time and in consequence of which they cannot sow their crops or water their fields in right time. They like to pay for irrigation water only when there are vagaries of nature. Such irregularities of rainfall occur for one or two years in a cycle of ten or twelve years.

The scheme as it appears to a poor pessimist like me is that the reservoir is in the upper reaches will be rapidly silted up thereby storage capacities required for effective flood protection will rapidly diminished with the reduction of flood controlling capacity of the scheme. The trouble will begin to arise within 10 years after completion and the project may have to be scrapped in a second ten years time. The idea of controlling erosion by planting trees in the watershed area is not workable proposition for an extensive basin, like this and in the end may be found to be ineffective. While selecting the source of watersupply for the Jharif coalfields I travelled along the course of the Damodar river in Manbhum and Hazaribagh districts for a considerable length. I found a very large number of ruts have been out into the banks, many of them 40 to 50 ft. deep and 20 to 30 ft. wide by the torrents of flow from the upper reaches on the sides. I saw on both the banks on many places also a fairly thick jungle of trees and shrubs and many of them has fallen inside the ruts and did not in any way prevent erosion of soil anywhere.

In conclusion, it must be pointed out that these are not the only problems that face West Bengal today; there are many others equally important which would receive careful attention of the State. A proper planning for development is urgently required to meet the situation and to enable the province to move onwards in her march to progress and prosperity.

(xiii)

If the recommendations made in the foregoing pages are adopted and carried out then the difficulties of rehabilitation will be considerably removed and the State should be self sufficient in cereals, fish, fruits, and other eatables. There should be positive improvement in sanitation and public health (at least in the most important parts of the state) so essential for the well being of the community.

Of these, the dangerous overcrowding of Calcutta requires immediate attention, otherwise, I am certain, the very existence of the city will be at stake in a few years time. The ravages wrought by the last influence of epidemic in 1918-19 may be in the momoray of many of us. An epidemic similar in virulence is at present, sweeping off thousands in North England, spreading as before towards the East and has already attacked the continent of Europe and a visitation of this scourage in spite of all medical ingenuity and precautions, can reasonably be expected here in the near future. If it visits this city in its present congested and morbid condition then it will surely levy a heavy toll of death by carrying of tens of thousands a day and a complete annihilation will no doubt result within a few weeks afterwards.

In conclusion, in my humble, I cannot help mentioning that the estimate given in the initial scheme of Damodar Project is very unreliable and I believe when the scheme is carried out successfully and brought to working condition, it will cost the Govt. five times the amount or more. It is not likely to be a paying concern. I wish only my assertion is wrong.

Appendix- 5.

Sri Kapil Bhattacharjee appeared before the Lower Valley Investigation Committee on 7-1-56 and gave his opinion.

My experience is that the river Damodar throws most of its heavier sand into the bed between Rhondia and Jamalpur. On the right bank there are so many Hanas and they flood the country. These areas may become water-logged [illegible] are (trans- Damodar area). They are water-logged because tidal water does not find way out as there is no flushing through Rupnarain.

By constructing DVC dams you are going to kill the river Hooghly very quickly. Last year the deterioration was rapid. The remedial measures, I have suggested in my book "Bangla Desher Nad-Nadi O Parikalpana" which I am handing over to the Committee to study. I have not made any scientific or mathematical calculation in support of my views. My views are mostly based on enquiry from local people.

I have no experience about the upper portion of Rupnarain.

I have no experience of Lower Damodar.

In about 50 years time Rupnarain will die if the present depth is not maintained. Amta channel upto Pallah I have seen. That will die very quickly in 20 years time. These channels will form so many beels and there will be no cultivation.

The river Hooghly will die in 5 years' time if nothing is done. Even what the Port Commissioners are doing they would not help the river Hooghly. That would have helped much if the floods are allowed to stay.

The remedial measures I have explained in my book. You have got to control the sea at the mouth. You will have to study the soil and work out scientific methods. I am sure for some time Calcutta Port will certainly die if the Govt. of India is not keen to revive it.

(ii)

Sri D. N. Sen appeared before the Lower Valley Investigation Committee on 7-1-56 and gave his opinion.

My experience will be out-of-date to some extent because in these years much has happened.

In these places you will find low land. This will require strong embankments. If you go over the country you will find embankments on both sides of Ghea and Kana Nadi. These were open channels previously. You will find at the opposite side of Jhujuty a stream of low depression about a mile away of Damodar which runs and joins the Mundeswari and falls into the Channel. There land formation has not proceeded so far. The area was fertile and clayey. On the other side of Damodar land is not fit for Rabi cultivation. The land formation is extensive and the ordinary flood do not cross it. As far as I can say that there were certain sections which were maintained right upto Amta. It was maintained 20 years back. From these sections it will be seen that land formation has not proceeded any further and neither the Damodar showed any signs of deterioration. About 1926 or 1927 Hurhura Khal was excavated. That indeed developed the countryside. More water was drawing into the Rupnarain improving the outlet.

Lot of sand used to come from Amta side. This shows that the amount of sand it carries from that side down the Lower Damodar is not always blessing. But, as a matter of fact, it is quite contrary. Regarding Jamalpur to outfall of Mundeswari opposite Gopigunge, this part of the country had a big channel. This upstream side of Gopigunge may be improved by DVC dams. This area had sericulture which has been spoilt on account of this flood conditions.

I have no knowledge or information so far as the sand carried by tidal water on this side of the Hooghly.

If the upland discharge is reduced there is a definite improvement in the fluctuation. There will be more extensive irrigation and quite an area will be brought under cultivation by the water (below Durgapur).

The river Hooghly will definitely be improved and also the Rupnarain. Regarding reservoir operation control I could say that we should not allow the river to widen like that. This will spoil all the channels. When the tides come our point should be to conserve the tidal energy as much as possible and should not be dissipated. Embankments should be put in to train the river where it requires. The river Rupnarain also should be trained. We should try to maintain a width and a deep channel. Regarding trans-Damodar area we should go as far as possible with the irrigation. All the Hanas should be controlled to some extent. Previously it was done in a kutcha way. I think, people will be benefited by it.

(iii)

Sri K.B.Ray appeared before the Lower Damodar Investigation Committee on 7.1.1956 and gave his opinion.

Q. Have you any personal experience and/or local knowledge of the areas served by Damodar from Durgapur up to its out fall into the Hooghly ?

A. "I have not gone round the river extensively. I have seen Kolaghat, Geonkhali. I have no experience."

Q. Could you tell us from your personal experience or study how each of the channels in this reach is functioning ?

A. "I have no experience."

Q. Have you any knowledge of the past behaviour of the Lower Damodar, Mundeswari and Rupnarain ?

A. "I have no experience."

Q. How long it will take them to deteriorate completely if left to themselves ?

A. "It will take 100 years from 1873 to 1973 to deteriorate if the channels are left to themselves under the present conditions."

Q. Under the post dam conditions what do you think will happen to these rivers ?

A. "Lower Damodar will accelerate deterioration after the construction of Dams & so also the Rupnarain."

"I cannot tell anything about the conditions of Hooghly unless I go through some maps and hydrographs."

Appendix- 6.

Estimation of the peak discharge of river Damodar at Champadanga during the flood of September 1956.

An attempt is made herewith to estimate the discharge that passed down the river Damodar at Champadanga from the available data. The H.F.L. at this site was attained on 27.9.56, at 12 midnight, the level being 47.30 in P.W.D. datum. Since no discharge observation was taken at this stage it became necessary to make the estimate from previous records of discharge and cross sections.

2. The following are the records that were available in this connection:-

(i) Cross section at the discharge site taken in 1950 (vide Report on "The effects of regulation of the Damodar River Flow by the D.V.C. Dams on the lower reaches of the river" by Dr.N.K.Bose, published in the Annual Report of the River Research Institute for 1952 pp 11-13. The cross section is shown in Fig.B-12p/89).

(ii) Cross section at the gauge site of the Irrigation & Waterways, (West Bengal) taken in 1955 (vide cross section as recommended by the lower Damodar Investigation Committee Dwg. No.C-812, Exhibit No.III).

(iii) Discharge data at Champadanga for the years 1949, 1951 and 1952 (observations taken by Planning Section of D.V.C.) Only monsoon period data were considered. The Executive Engineer, Hooghly Irrigation Divn. was also consulted if he had any cross section taken at Champadanga. He reported that he had no cross section taken at the site nor he had any information if any such cross section was taken at any time. The cross section No.(i) gives R.L.'s in G.T.S. datum, while the C.S. No.(ii) gives R.L.'s in P.W.D. datum. In the discharge data the R.L. is not mentioned but it appears from the plotting of the data reported later, that the G.T.S. datum has been used for 1951 and 1952, and probably P.W.D. datum in 1949.

3. The estimation has been made by different methods as follows :-

(i) by extension of rating curve.

The gauge relationship has been obtained by plotting the observed data for 1949, 1951 and 1952 (see Fig.1). A good amount of scatter is noticed among the plotted points.

(ii)

In particular the points for 1949 show somewhat higher gauges than the points for the other two years. This may probably be due to the R.L. in 1949 being expressed in P.W.D. datum and the same in the later years in G.T.S. However a mean curve on the 1951 and 1952 data has been drawn and the curve graduated by a formula of the form

$$Q = C(G-a)^n ,$$

where c, a & n are constants. This gives a linear relationship between log Q and log (G-a). The value of 'a' has been found by trial and error (see Fig.2) and is 31.8. The rating curve has been extended from this straight line (see Fig.3). The flood peak was 47.30 in P.W.D. datum, i.e. 45.79 in G.T.S. datum. Since the datum in the observed data for 1951 and 1952 is not mentioned, the discharge has been estimated for both the levels 47.30 and 45.80. These are

Q (for G = 47.30) = 29,300 cusecs.

Q (for G = 45.80) = 23,700 cusecs.

The latter discharge seems to more probable, since the datum in the rating curve appears to be in G.T.S.

(ii) From observed data of gauge and velocity for all the flood peaks.

In the discharge calculations the surface velocities in different spans were also given. These have been utilised to obtain the average surface velocity, and from these a curve for velocity against gauge was obtained. Since it is required to make the estimation for the peak discharge, the data for only peak discharges have been utilised. The data plotted in the gauge-velocity graph (vide Fig.4) indicate a good trend and the surface velocities obtained for the above levels are

v (for G = 47.30) = 5.85 ft/sec.

v (for G = 45.80) = 5.45 ft/sec.

The sectional area corresponding to the level 47.30 P.W.D. i.e. 45.80 G.T.S. obtained from cross section (i) at the discharge site in 1950 was 4,872 sq.ft. The computed discharge from these data corresponding to the above levels are

Q (for G = 47.30) = 4872 x 5.85 x 0.89 = 25,366 cusecs.

Q (for G = 45.80) = 4872 x 5.45 x 0.89 = 23,632 cusecs.

(iii)

(It may be stated here that the cross sections (i) and (ii) mentioned before are different and give different values for the sectional area with the same gauge reading. It may be that the sites for gauge observations (Irrigation & Waterways, West Bengal) and that for discharge observation (D.V.C.) are not same. No correct information was available on this point. The figure for the sectional area obtained above was checked also from the discharge and velocity data for flood peaks and values of corresponding sectional areas were calculated, by the relation $A = \frac{Q}{.89 \times V_s}$.
These plotted against the gauge show a good relation for the area gauge curve (see Fig.5) and the area corresponding to the gauge height of 45.80 G.T.S. from this curve is 4,825 sq.ft. This is in close agreement with the value obtained as above. A gauge discharge curve was also obtained from the values of gauge and discharge for these flood peaks (see Fig.6). This rating curve is also in close agreement with the one referred to para 3(i).)

(iii) By use of hydraulic formulae of Chezy Manning and Lacey.

The discharge was also estimated from the cross section (ii) taken in 1955 and the H.F.L. recorded by the slope-area method with the help of different empirical formulae like Chezy's, Mannings' and Lacey's. The relevant hydraulic data are as follows :-

R.L. in P.W.D.	Sectional area in sq.ft.	Wetted Perimeter in ft.	Hydraulic Radius in ft.	Slope between Jearah & Champadanga.
47.30	7,122	1,189	5.99	0.28 per thousand.

The slope was obtained from the difference in levels at Jearah and Champadanga at peak stage, the distance between the two stations being taken as 6½ miles.

The calculated values are :-

(a) Chezy's formula (Kutter's n = 0.025).

Chezy's C = 81.22 ;

V = C /RS = 3.33 ft/sec. ;

Q = V x A = 23,715 cusecs.

(iv)

(b) Mannings' formula (n = 0.025).

$V = 3.28$ ft/sec.

$Q = A \times V = 23,360$ cusecs.

(c) Lacey's formula

$V = 16\ 3/R^2 S = 3.45$ ft/sec.

$Q = A \times V = 24,587$ cusecs.

Conclusion.

Thus the probable value of the discharge of Damodar at Champadanga at the highest stage of the flood of Sept/56 is found to be as follows by various methods of computation :

1). From calculation with the available cross section at Champadanga (taken in 1955) :-

(a) by Chezy's formula - 23,715 cusecs.
(b) by Mannings' formula - 23,360 cusecs.
(c) by Lacey's formula - 24,587 cusecs.

2). From extension of Rating curve (1951-52) - 23,700 cusecs.

3). From velocity - gauge curve and available cross section (1950) - 23,632 cusecs.

Now against serials (2) and (3) as shown above the calculated discharge will be 29,300 cusecs and 25,866 cusecs respectively if the R.L.'s of observations in 1951-52 were in P.W.D. datum and not in G.T.S. datum as assumed by us. But in all probabilities the datum for these observations appear to refer to G.T.S. datum. So I consider that the maximum discharge at Champadanga at the highest stage of the flood of 1956 was not more than 25,000 cusecs.

Sd: B. Maitra
28/2/57
Director,
River Research Institute, West Bengal.

Appendix- 7.

GOVERNMENT OF WEST BENGAL
OFFICE OF THE EXECUTIVE ENGINEER
DAMODAR CANAL DIVISION, BURDWAN
IRRIGATION & WATERWAYS DIRECTORATE

From: Executive Engineer
Damodar Canal Division, Burdwan.

Subject: Flood flows and spilling through Hanas on the Right Bank of the Damodar.

No. 143 dated 12th January, 1956.

To
The Member-Secretary,
Lower Damodar Investigation Committee,
C/o Director, River Research Institute,
West Bengal.

Ref:- Your No.DE-3/1/19-186 dated 7th January, 1956.

The informations as wanted are furnished in the enclosed statements.

There is no Gauge or discharge observation stations on the hanas. The data are however collected by referring to the existing Gauge Stations on the Damodar and assuming an average velocity of 4 ft/sec. in the Hana.

The recorded floods at Rondia may not be the peak-floods on each occasion as the observations are normally taken at fixed hours of a day except when the danger level is crossed.

Sd: 12.1.56
(N. K. Saha)
Executive Engineer
Damodar Canal Division.

Enclo: Statement - 5 sheets.

(ii)

Year 1951.

A. Flood flows above 50,000 cusecs during monsoon month in river Damodar :-

Month.	Date. (1)	Recorded flow at Rondia.	No. of floods above 50,000 cusecs. (2)
June ..	-	-	-
July ..	(a) 6.7.51 to 7.7.51	1,07,409 cusecs.	2
	(b) 12.7.51 to 13.7.51	83,256 "	
August ..	17.8.51 to 19.8.51	74,725 "	1
September ..	(a) 7.9.51	53,723 "	2
	(b) 11.9.51	3,89,131 "	
October ..	Nil	-	-

B. (3) Discharge in the Hanas during above flood occasions.

Sl. No.	Name of Hana.	Approximate discharge in cusecs during floods on 6.7.51 to 7.7.51	12.7.51 to 13.7.51	17.8.51 to 19.8.51	7.9.51.	11.9.51.	Remarks.
1.	Panchpara ..	2506	1620	2038	1412	4184	
2.	Bhasna ..	346	120	330	190	1512	
3.	Kumirkhola ..	- - - - - - - - - - Closed by Cross Bundh - - - - - -					Controlled by Weir.
4.	Gurpur ..	2344	2340	1980	1506	3520	
5.	Gaitanpur ..	1532	960	1310	832	3248	
6.	Barasat ..	2856	804	2640	1536	7684	
7.	Jakta ..	1470	416	1320	200	2676	
8.	Mohanpur ..	14897	5433	9978	1750	40909	-do-
9.	Jamda ..	1960	1626	1900	1264	3112	
10.	Lakra ..	-	-	-	-	642	Controlled by Regulator.
11.	Krishnapur ..	-	-	-	-	514	

Sd: N. K. Saha 12/1/56
Executive Engineer
Damodar Canal Division.

(iii)

Year 1952

A. Flood flows above 50,000 cusecs during monsoon month in River Damodar :-

Month	Date.	(1) Recorded flow at Rondia.	(2) No. of floods above 50,000 cusecs.
June ..	-	-	-
July ..	(a) 5/6.7.52 ..	51,957 cusecs.	
	(b) 26/27.7.52 ..	1,80,909 "	2
August ..	(a) 20.8.52 ..	66,509 "	
	(b) 22.8.52 ..	53,106 "	2
September ..	(a) 11/12.9.52 ..	1,69,891 "	
	(b) 23.9.52 to 25.9.52	66,631 "	2
October ..	11,10,52 ..	55,983 "	1

B.

(3) Discharge in the Hanas during above floo occasions.

Sl. No.	Name of Hana.	Approximate discharge in cusecs during floods on 5/6.7.52.	26/27.7.52.	20.8.52.	22.8.52.	11.9.52 to 13.9.52	23.9.52 to 25.9.52	11.10.52	Remarks.
1.	Panchpara	-	2644	1932	-	2172	1908	-	
2.	Bhasna	-	526	342	-	388	288	-	
3.	Kumirkhola	- - - - - - - - - - - - - - - - - Closed by Cross Bundh -							Controlled by Weir.
4.	Gurpur	764	1300	886	856	1168	1036	1296	
5.	Gaitanpur.	786	1992	1320	1016	1690	1434	912	
6.	Barasat	2010	3728	2460	2014	3268	2870	1888	
7.	Jakta.	738	1238	810	652	1060	906	540	
8.	Mohanpur.	300	2028	9300	2952	1428	9500	590	Controlled by Weir.
9.	Jamda.	1216	2594	1858	1612	2312	2070	1092	
10.	Lakra.	-	20	-	-	-	-	-	Controlled by Regulator.
11.	Krishnapur.	-	-	-	-	-	-	-	

Sd: N. K, Saha 12/1/56
Executive Engineer
Damodar Canal Division.

(iv)

Year 1953

A. Flood flows above 50,000 cusecs during monsoon month in river Damodar.

Month.	Date.	(1) Recorded flow at Rondia.	(2) No. of Floods above 50,000 cusecs.
June.	-	-	-
July.	(a) 4.7.53 to 15.7.53	2,28,688 Cusecs.	
	(b) 18.7.53 to 19.7.53	51786 "	3
	(c) 28.7.53 to 30.7.53	77,016 "	
August.	(a) 4.8.53 to 6.8.53	89,856 "	
	(b) 12.8.53 to 13.8.53	68,839 "	4
	(c) 15.8.53 to 18.8.53	83,705 "	
	(d) 20.8.53 to 30.8.53	2,92,834 "	
September.	(a) 10.9.53 to 12.9.53	93,205 "	
	(b) 14.9.53 to 15.9.53	80,625 "	4
	(c) 17.9.53 to 20.9.53	85,349 "	
	(d) 28.9.53 to 30.9.53	1,69,220 "	
October.	-	-	-

B. (3) Discharge in the Hanas during above flood occasions.

Sl. No.	Name of Hana.	Appropriate discharge in cusecs during floods on – 4.7.53 to 15.7.53	18.7.53 to 19.7.53	28.7.53 to 30.7.53	4.8.53 to 6.8.53	12.8.53 to 13.8.53	15.8.53 to 18.8.53	20.8.53 to 30.8.53	10.9.53 to 12.9.53	14.9.53 to 15.9.53	17.9.53 to 20.9.53	28.9.53 to 30.9.53	Remarks.
1.	Panchpara	3,374	2,290	2,400	2,584	2,434	2,400	3,732	2,258	2,500	2,700	3,068	
2.	Bhasna -	616	338	362	410	270	362	1,552	324	360	428	526	
3.	Kumirkhola -	Closed by cross bundh						16,331	4,758	5,289	7,253	9,758	Controlled by Weir.
4.	Gurpur -	4,430	3,262	3,140	3,538	3,398	3,140	3,938	3,250	3,250	3,548	3,824	
5.	Gaitanpur -	2,156	1,434	1,458	1,602	1,462	1,458	2,504	1,402	1,470	1,568	1,732	
6.	Barsut -	4,040	2,964	2,972	3,096	2,956	2,972	4,524	2,952	1,672	3,040	3,544	
7.	Jakta -	1,360	974	978	690	590	968	1,563	942	882	1,002	1,164	
8.	Mohanpur -	29,983	17,298	16,398	19,143	16,075	16,398	38,829	16,700	14,464	15,427	21,334	Controlled by Weir.
9.	Jamda -	2,054	2,272	2,258	2,380	2,240	2,258	3,152	2,240	2,028	2,510	2,674	
10.	Lakra -	197	-	-	-	-	-	403	-	-	-	-	Controlled by
11.	Krishnapur -	-	-	-	-	-	-	678	-	-	-	-	Regulator.

Sd: N. K. Saha 12/1/56

Executive Engineer,
Damodar Canal Division.

Year - 1954.

A. Flood flows above 50,000 cusecs during monsoon month in river Damodar.

Month.	Date.	(1) Recorded flow at Rondia.	(2) No. of Floods above 50,000 cusecs.
June -	-	-	-
July -	30.7.54	62,951 cusecs.	1
August -	a) 8.8.54 to 19.8.54	56,652 "	2
	b) 21.8.54 to 22.8.54	93,839 "	
September -	a) 8.9.54 to 11.9.54	2,61,736 "	2
	b) 17.9.54 to 20.9.54	66,068 "	
October -	-	-	-

B. Discharge in the Hana during above flood occassions -

Sl. No.	Name of Hana.	Approximate discharge during floods on - 29.7.54 to 30.7.54	18.8.54 to 19.8.54	21.8.54 to 22.8.54	8.9.54 to 11.9.54	17.9.54 to 20.9.54	Remarks.
1.	Panchpara -	2,310	1,628	2,708	3,718	2,232	
2.	Bhasna -	348	246	472	1,194	252	
3.	Kumirkhola -	-	-	5,317	13,664	-	Controlled by Weir.
4.	Gurpur -	1,724	1,574	2,012	2,840	1,592	
5.	Gaitanpur -	1,468	1,156	1,932	3,180	1,182	
6.	Barsut -	1,936	1,610	2,470	6,822	1,634	
7.	Jakta -	664	480	1,478	2,346	534	
8.	Mohanpur -	5,882	2,358	12,858	32,112	2,564	Controlled by Weir.
9.	Jamda -	1,652	1,304	3,304	4,628	1,380	
10.	Lakra -	-	-	-	114	-	Controlled by Regulator.
11.	Krishnapur -	-	-	-	-	-	

Sd: N. K. Saha 12/1/56
Executive Engineer,
Damodar Canal Division.

(vi)

Year 1955.

A. Flood flows above 50,000 cusecs during monsoon month in river Damodar -

Month.	Date.	Recorded flow at Rhondia.	No.of floods above 50,000 cusecs.
June -	-	-	-
July -	28.7.55	58,663 cusecs.	1
August -	13.8.55	52,479 "	1
September -	-	-	-
October -	-	-	-

B. Discharge in the Hana during above floods occassions -

Sl. No.	Name of Hana.	Approximate discharge in cusecs during floods on - 28.7.55	13.8.55	Remarks.
1.	Panchpara -	-	-	
2.	Bhasna -	-	-	
3.	Kumirkhola -	-	-	Controlled by Weir.
4.	Gurpur -	826	534	
5.	Gaitanpur -	106	126	
6.	Barsut -	658	476	
7.	Jakta -	304	300	
8.	Mohanpur -	-	-	Controlled by Weir.
9.	Jamda -	-	-	
10.	Lakra -	-	-	Controlled by Regulator.
11.	Krishnapur -	-	-	

Sd: N. K. Saha
12/1/56
Executive Engineer,
Damodar Canal Division.

Appendix- 8.

Copy of letter No.12537 dated 19.12.55 from Superintending Engineer, Eastern Circle to the Chief Engineer, West Bengal, I. & W. Directorate.

Subject - Paper cutting from 'Swadhinata' dated the 9th May, 1955.

With reference to your Memo. No.3599(3)-C.I. dated 12.5.55 I beg to state that it has not yet been possible to arrange a joint inspection with the Superintending Engineer, Western Circle. As I am handing over charge of the Circle on 19.12.55, I have inspected the area independently on 14.12.55 and am submitting this report.

The paper cutting deals with the difficulty in irrigating fields on the river side of the D.L.Embankment for Rabi cultivation and difficulty in plying boats between Buxi a big trade centre and lower portion of the Damodar below Mahishrekha due to formation of a Char in the bed of the Damodar near its junction with the Gaighata Buxi Khal.

I was completely taken aback at seeing the present condition of the River Damodar between Mahish-rekha and the junction of the Gaighata Buxi khal. In the year 1940, when I was in charge of the Seijberia Subdivision, the Damodar in this portion was a live river and there were plaguepots at Mahishrekha and joka where costly protective works had to be executed due to erosion. But it was now found that the section of the channel has considerably shrunk leaving only a narrow gutter.

At Mahishrekha the bed width of the channel was found to be about 30' ft. and the depth of water 4' ft. The range of tide at this place was reported to be about 4' ft. during the spring tide.

At Joka the channel has been reduced to a narrow gutter of about 5' ft. bed width and the depth of water is about 1 ft. The range of tide at this place is about 2' ft. during the spring time. During the neap tide at this time of the year, no tide goes upto this place.

The River Damodar was found to be high dry at its junction with the Gaighata Buxi khal and extending over a distance of about 2 miles below the junction. At the junction a sudden drop in the bed of the channle was noticed and the bed below the junction was found to be about 2' higher than the same above the junction. In this portion no tide-water comes during the dry season even at the spring tide.

(ii)

Above the junction of the Gaikata Buxi Khal the Damodar was found to be in a better condition than that of the same lower down. The bed-width of the channel in this portion was found to be about 15 ft. and the depth of water was about 2 ft. The range of the tide at this place was reported to be 2 ft. during the spring tide. This tide comes from the river Rupnarayan through the Gaighata Buxi khal. During the neap tide, however, no tide plays in this portion.

It was learnt from the S.D.O., Trans Damodar Subdivision who was present during my inspection that in the upper portion, i.e., between the junction of the Gaikata Buxi Khal and Amta, progressive deterioration of the Damodar has taken place and the bed of the channel has risen considerably than what it was before.

Between Mahishrekha and the junction of the Gaighata Buxi Khal rabi crop is cultivated on the char land of the Damodar. These lands are irrigated by taking water from the Damodar by lift irrigation. Due to the deteriorated condition of the Damodar as stated above it is no longer possible to irrigate these lands. It is not also possible to ply boat between Buxi which is a big trade centre and the lower portion of the Damodar below Mahishrekha during the dry season due to the same reason.

My impression is that previously about 25% of the water coming from the upper Damodar used to flow through this portion, the remaining 75% flowing through Muchihana and other spill channels on the right bank of the Damodar. But at present only 4.5% of the discharge that passes Rondia at the bank-full stage flows into the Amta-Champadanga arm of the Damodar and at the average maximum stage of the river it is only 7% as seen from Annual Report of River Research Institute for 1952. The progressive deterioration of the lower portion of the Damodar appears to be due to diversion of more and more up-land water through the Muchihana and other right bank spill channel.

Previously the tides coming up the Rupnarayan and the Damodar used to meet within the Gaighata Buxi Khal near Kariya where heavy silting took place. Due to progressive deterioration of the Damodar the tide coming through the Damodar became gradually weak and the tidal meeting ground was gradually shifted from Kariya towards the south. Now-a-days, the meeting of the two tides takes place within the Damodar below the junction of the Gaighata Buxi Khal. This seems to me to be the reason why heavy silting has taken place just below the junction of the Gaighata Buxi Khal.

(iii)

The public feeling in the locality is that the heavy silting that has taken place at the junction of the Gaighata Buxi khal is due to execution of the Damodar Valley Project. I think this is not correct as out of 8 No. dams proposed to be constructed only two viz. at Tilaiya and Konar, have been completed. The construction of these two dams, which control a fraction of the catchment, cannot have so much repercussion on the portion lower down. In my opinion the heavy deterioration of the portion referred to is due to progressive deterioration of the lower portion of the Damodar due to gradual diversion of more and more upland flood water through spill channels on the right bank and gradual shifting of meeting ground of tides within the Gaikata Buxi Khal towards the south as stated above.

The re-excavation of the deteriorated portion as referred to in the paper cutting will be of very little use as the excavated channel will soon be filled up as this portion of the channel is now the meeting ground of the two tides coming from the Rupnarayan and the Damodar respectively.

After the execution of the Damodar Valley Project, it is expected that there will be a further deterioration of the lower portion of the Damodar unless some arrangement is made to divert some flow through the Muchihana into the Amta-Champadanga arm of the Damodar. This question may kindly be taken up with the D.V.C.

An index map illustrating this report is submitted herewith.

Appendix- 9.

RUPNARAIN CUBATURES AND ITS TIDAL DATA*

1. Introduction

The Rupnarain is formed at Bandor by the confluence
Fig.1 of Dalkhisor and Selai rivers - Fig.1. After passing Tamluk, it expands into a wide basin and then enters the Hooghly through a narrow neck at Gewankhali opposite Hooghly Point. About 15 miles above Tamluk, at Kolaghat, it is crossed by the Eastern Railway and 10 miles further up, the Bakshi khal on the left bank connects the Damodar with Rupnarain through the Ghaighata khal. The capacity of the Selai at its confluence with Dalkhisor is 21,566 cusecs as stated by Reaks in his report. There are no data regarding the total discharges of the two rivers but working on the data of average rainfall of 50 inches, Reaks has worked a quantity of total volume of water of 7000 million cubic yards.

The Kosai river spills over its left bank below Midnapur into the Selai. It has been calculated that out of a total flood discharge of Kosai of 187000 cusecs at Midnapur, 142000 cusecs spilled over the left bank into the Selai. Owing to the restricted channels of Kosai at Ghatal and Dalkhishor at Bandor the surrounding country-side is subjected to severe inundation which is accentuated by the backing up of this water when there is a heavy flood spill from Damodar into the Rupnarain. The combined spill waters pass through the narrow neck at Bakshi Khal and it is estimated that at Kolaghat bridge the maximum discharge of the Rupnarain is 2,35,000 cusecs.

The Damodar river after passing Burdwan takes right angled bend above Selimabad and then flows south past Amta to fall into the Hooghly opposite Fulta Point. Since 1865, when the great Begua breach occurred in the abandoned right embankment near Burdwan, practically all the heavy spill from high floods has poured over the right bank and through the country to the west of Damodar into the head of the Rupnarain between Bandor and Ranichak. In 1913, with a peak flood of 6,50,000 cusecs at Raniganj, 4,00,000 cusecs spilled over the right bank above and below Burdwan to flow into the Bakshi basin of the Rupnarain, 50,000 cusecs passed through the Amta channel while the remainder spilled through the breaches in the left embankment to flow into Hooghly via old Damodar channels.

In addition to the fresh water-supply, the Rupnarain provides a magnificant basin or reservoir for the

reception of tidal water and the influence of this river on the Hooghly is shown in the splendid wide and deep channel scoured from the confluence right down to Kalpi, a distance of nearly 15 miles, by the combined discharges of the two rivers.

The Damodar Valley Project envisages construction of a series of dams and barrages which ultimately will have the effect of reducing the freshet discharges of the Rupnarain and a possible effect of this aspect on the navigation in the Hooghly has been a point of discussion for some time. Obviously, to assess the effect of reduced discharges, one might have been able to do so had past data of discharge and charge of the various channels together with survey plans been available. Unfortunately, for want of data this has not been possible. However, with whatever little data that could be collected, an attempt is made to asses the trend of the existing tidal conditions of the Rupnarain.

2. The Data

The data analysed for the purpose consists of survey plans of the years 1938, 1944 and 1954, mean high and low waters at Gopiganj and Bandor 32 and 41½ nautical miles above Hooghly Point calculated from December to May for lunations between new moons of successive years.

3. Capacities

From the survey plans of 1938, 1944 and 1954 extending from Natshal at the Rupnarain Outfall up to Bakshi, capacities between adjacent cross sections were worked out to a datum 10 ft above K.O.D.S. Fig.2 shows a plot of the 1938 and 1944 superimposed corresponding capacities while Fig.3 shows a similar plot for 1944 and 1954 capacities. One feature which appears common to both is that scouring and silting occur alternately throughout the reach. Between 1938 and 1944, the reach near Kolaghat scoured (fig.2) whereas between 1944 and 1954 the same reach accreted (fig.3). On the other hand, the reach between Shashati and Gopra accreted between 1938 and 1944 (fig.2) but subsequently it scoured (fig.3).

Fig.2. Fig.3. Fig.2. Fig.3. Fig.2. Fig.3.

The overall capacities of the entire reach for the three years were as follows :-

Year	Capacity in mill.cu.yds. below + 10 ft datum (K.O.D.S.)
1938	321.73
1944	319.56
1954	321.46

(iii)

It will be observed that between 1938 and 1944 there was a slight reduction in cubatures but by 1954 the cubature was practically the same as in 1938. In other words, it is fair to say that the river has maintained its tidal reservoir capacity since 1938.

Fig.4. A comparison of 1938 and 1954 plan shows that considerable changes have taken place in the river banks. About 5 miles above its outfall, from about Dhanipur to little above Mathuri, the right bank has receded, for a length of about 5 miles, the maximum recession being a little short of 1 mile; however the left bank remained the same. Above this reach up to Soyadighi the right bank has advanced inwards to constrict the section. Higher up also similar changes have taken place. The rapidity with which the river changes take place is clearly brought out by Reaks when he stated "..... in a survey which was being made, the coast line had to be mapped and soundings adjacent taken almost simultaneously and the whole work had to be completed in a fortnight, otherwise parts of the charts would have changed in relation to each other."

Considering these changes and knowing that the river bank line is generally + 18 ft it was considered instructive to see changes in river capacities up to say + 16 level which generally includes all the sands.

These capacities were as under :

Year	Cubic capacity below + 16 ft datum in mill. cubic yards.
1938	555.91
1944	550.65
1954	551.10

It will be noticed that the 1954 capacity is only about one per cent less than that in 1938.

The results thus presented thus clearly show that, though the river has changed considerably, yet it has maintained its capacity to impound tidal waters since 1938.

4. River Behaviour prior to 1938

Unfortunately no data of river surveys prior to 1938 is available for computing cubatures but the data of low water and ranges at Gopigunj and Bandor about 32 and

and 41½ nautical miles above Hooghly Point may be expected to throw some light on the general river conditions. The low waters and ranges are plotted in Fig.5 from 1922 to 1941 in the case of Gopigunj gauge and from 1922 to 1944 in the case of Bandor gauge.

Fig.5.

From 1922 to 1937, the low waters show a rising trend, the rise being more at Gopigunj than at Bandor. The Gopigunj low water has risen much more than at Bandor during the period 1932 to 1937. The ranges also show a falling trend which in turn shows the deterioration of river capacity since 1922. From 1937 onwards, however, there does not appear any trend of rise in low waters and fall in ranges at either Bandor and Gopigunj. In other words, it may be concluded that though the river has deteriorated as compared to its condition in 1922, status quo has been maintained since about 1937 and as such the cubatures worked out have remained practically the same.

The possible reason for deterioration in the period prior to 1937 may be found in the statement made by Reaks in his 1919 report viz., "As in the case of Rasulpur and Haldia Rivers, tidal spill in the upper portion of Rupnarain has been completely restricted by the construction of embankments shutting out the tidal waters. This action has ruined rivers, such as Rasulpur and others in the Sunderbans."

This statement throws ample light on the conditions. It may be said that due to the embankments the Rupnarain lost its capacity and has reached stability by about 1938 as shown by the cubature remaining practically the same since then.

(NOTE: Figures 1, 2 & 3 are not included.)

* The above note along with the figures was received from the Director, Central Water and Power Research Station, Poona under his letter D.O. No.87/427 dated 1-6-1955.